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What is claimed is:

1. Apparatus for enhancing combustion comprising:

an enclosure defining an opening for introduction of a gas and

15 openings for the introduction of air;

a nozzle in said opening for introduction of a fuel gas into said enclosure;

first and second electrodes located in said enclosure, said first and second electrodes being coated with dielectric material, and being
20 connected to an electrical power supply;

wherein, with electrical power applied to said first and second electrodes and with said fuel gas sprayed into said enclosure, an atmospheric pressure plasma created by a dielectric barrier discharge is produced in said enclosure that cracks said fuel gas prior to its mixing with
25 air introduced through said openings for the introduction of air.

2. The apparatus as described in Claim 1 wherein said fuel gas is an atomized liquid fuel.

30 3. The apparatus as described in Claim 1 wherein said fuel gas is propane.

4. The apparatus as described in Claim 1 wherein said fuel gas is natural gas.

5 5. The apparatus as described in Claim 1 wherein said fuel gas is atomized
Jet A fuel.

6. The apparatus as described in Claim 1 wherein said fuel gas is atomized
Jet B fuel.

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7. The apparatus as described in Claim 1 wherein said fuel gas is atomized
JP-10 fuel.

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8. The apparatus as described in Claim 1 wherein said dielectric material has
a catalytic material deposited onto it at predetermined non-contiguous areas
to enhance cracking of said fuel gas.

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9. The apparatus as described in Claim 8 wherein said catalytic material is at
least one transition element.

10. The apparatus as described in Claim 8 wherein said catalytic material is
an alloy of two or more transition elements.

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11. The apparatus as described in Claim 8 wherein said at least one
transition element is platinum.

12. The apparatus as described in Claim 1, wherein said electrical power
supply provides radio frequency power having a frequency of 13.56 MHz.

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13. The apparatus as described in Claim 1, wherein said electrical power
supply provides pulsed direct current power.

14. The apparatus as described in Claim 1 wherein said electrical power
supply provides sub-radio frequency alternating current power.

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- 10 15. A method of increasing the efficiency of combustion processes comprising the steps of: producing an atmospheric pressure plasma created by dielectric barrier discharge;
spraying a fuel gas into said atmospheric pressure plasma;
wherein said atmospheric pressure plasma cracks said fuel gas.
- 15 16. The method as described in Claim 15, wherein said fuel gas is an atomized liquid fuel.
- 20 17. The method as described in Claim 15, wherein said fuel gas is propane.
18. The method as described in Claim 15, wherein said fuel gas is natural gas.
- 25 19. The method as described in Claim 15, wherein said fuel gas is pure methane.
20. The method as described in Claim 15, wherein said fuel gas is atomized Jet A fuel.
- 30 21. The method as described in Claim 15, wherein said fuel gas is atomized Jet B fuel.
22. The method as described in Claim 15, wherein said fuel gas is atomized JP-10 fuel.

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23. The method as described in Claim 15, further comprising the step of heating said fuel gas before said fuel gas is sprayed into said atmospheric pressure plasma.

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24. The method as described in Claim 15, wherein said atmospheric pressure plasma is produced using an electrical power supply.

25. The method as described in Claim 24, wherein said electrical power supply provides radio frequency power.

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26. The method as described in Claim 24, wherein said radio frequency power has a frequency of 13.56 MHz.

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27. The method as described in Claim 24, wherein said electrical power supply provides pulsed direct current power.

28. The method as described in Claim 24, wherein said electrical power supply provides sub-radio frequency alternating current power.

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29. Apparatus for enhancing combustion comprising:

separate supplies of fuel and air;

valve means for controlling the flow of fuel and air;

plasma processing means receiving said fuel and air for selectively pre-cracking said fuel and exciting said air and outputting said pre-cracked fuel and excited air to a combustor.

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30. The apparatus as described in Claim 29, wherein said fuel is pre-cracked prior to being output to said combustor, and said air is output directly to said combustor.

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31. The apparatus as described in Claim 29, wherein said air is excited prior to being output to said combustor, and said fuel is output directly to said combustor.

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32. The apparatus as described in Claim 29, wherein said fuel is pre-cracked and said air is excited prior to being output to said combustor.